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WAR DEPARTMENT

TECHNICAL MANUAL

ORDNANCE MAINTENANCE
SIGHT, M1901 (FRENCH)

May 31, 1941



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TECHNICAL MANUAL
No. 9-1550

TM 9:1550



WAR DEPARTMENT,
WASHINGTON, May 31, 1941.

ORDNANCE MAINTENANCE
SIGHT, M1901 (FRENCH)

Prepared under direction of the
Chief of Ordnance

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SECTION I

GENERAL

Purpose	Paragraph
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1. **Purpose.**—This manual is published primarily for the information and guidance of ordnance maintenance personnel.

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2. Scope.—The manual contains descriptive matter and illustrations sufficient to provide a general working knowledge of the sight, and in addition contains detailed instructions for the maintenance and adjustment of the sight by ordnance personnel. Figures which accompany the text show the construction of the sight and the placement and method of fastening for each of the component parts.

3. References.—The appendix contains references to all Standard Nomenclature Lists and other publications applicable to the equipment described herein.

SECTION II

DESCRIPTION

	Paragraph
Sight, M1901 (French)	4
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4. Sight, M1901 (French).—*a.* The sight, M1901 (French), is for use with 75-mm gun carriages, M1897, M1897MI, M1897A2, M1897M1A2, and M1897A4.

b. The sight consists principally of two units, the collimating sight and the sight mount. These units are shown in figure 1.

c. The sight contains mechanisms for giving direction to the piece and for setting off the angle of site. The collimating sight is arranged to be turned through an angle of 200 mils by the deflection mechanism of the sight mount, and the collimator thereon is arranged to be turned in integral 200-mil steps, the combination affording a setting for any required value of azimuth or lateral deflection. The entire sight is elevated or depressed by the angle of site handwheel of the gun carriage. Angle of site is introduced either by means of the collimator line of sight (direct fire), or by use of a level which is arranged to be inclined as required (indirect fire).

5. Sight mount.—*a.* The sight mount (figs. 2 and 3) consists principally of the sight mount bracket, CH3A, the deflection screw mechanism, and the angle of site mechanism.

b. The sight mount bracket, CH3A, is attached to an extension which is integral with the left rocker arm of the carriage. Attachment is by means of a nut threaded on a stud of the rocker-arm extension and a nut, A39879, threaded on the sight mount bracket mounting screw, A39878. The tail of the bracket fits between two lugs projecting from the rocker-arm extension, which contain adjusting screws for alining the sight.

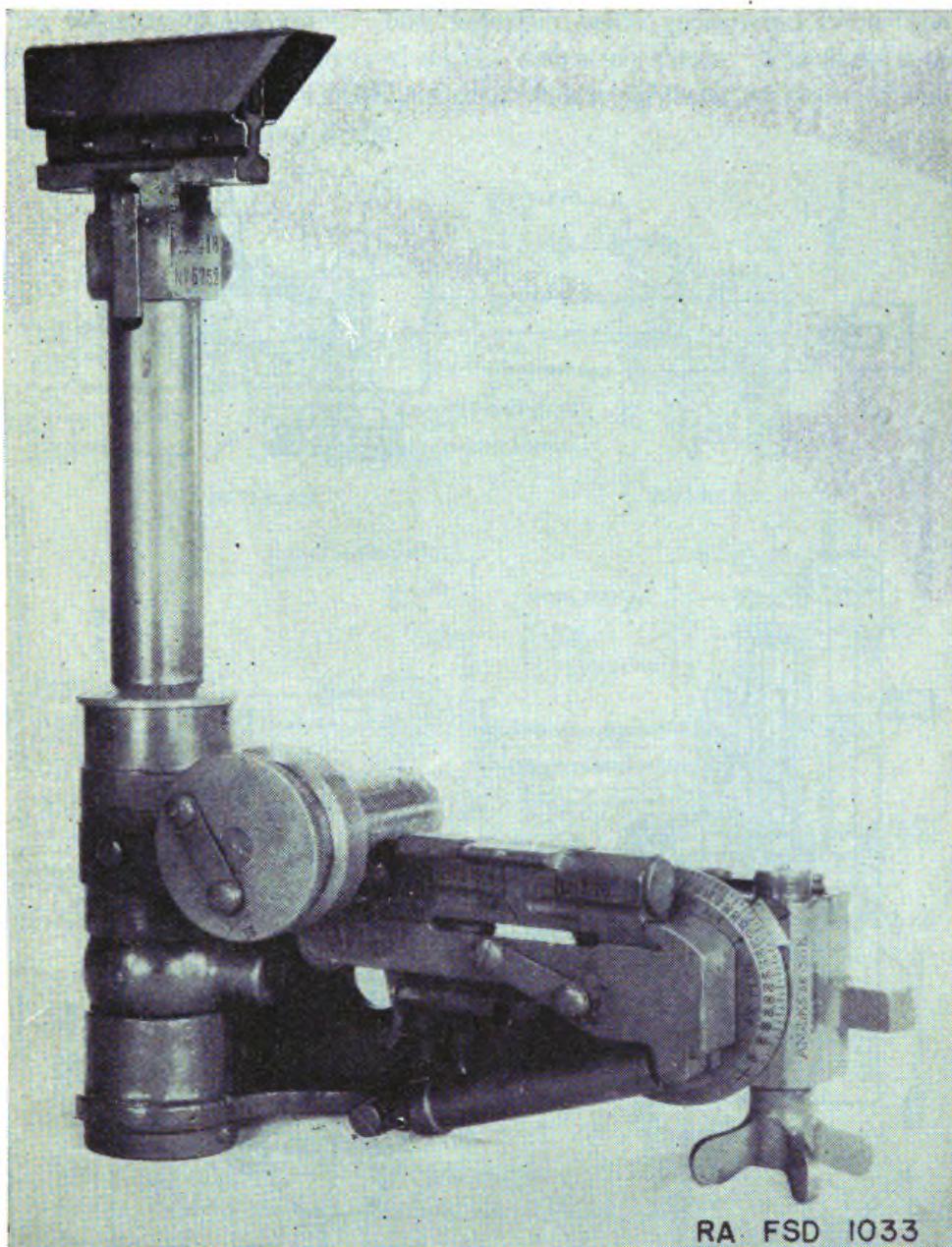


FIGURE 1.—Sight, M1901 (French).

c. The sight socket, CH4A, which receives the collimating sight is mounted for rotation in a vertical bearing in the forward portion of the sight-mount bracket, CH3A. Rotation of the sight socket, CH4A, is effected by the deflection knob, CH5A, and deflection-screw mechanism as shown in figure 3, section C-C. Rotation of the deflection knob is limited to a single turn, corresponding to a deflec-

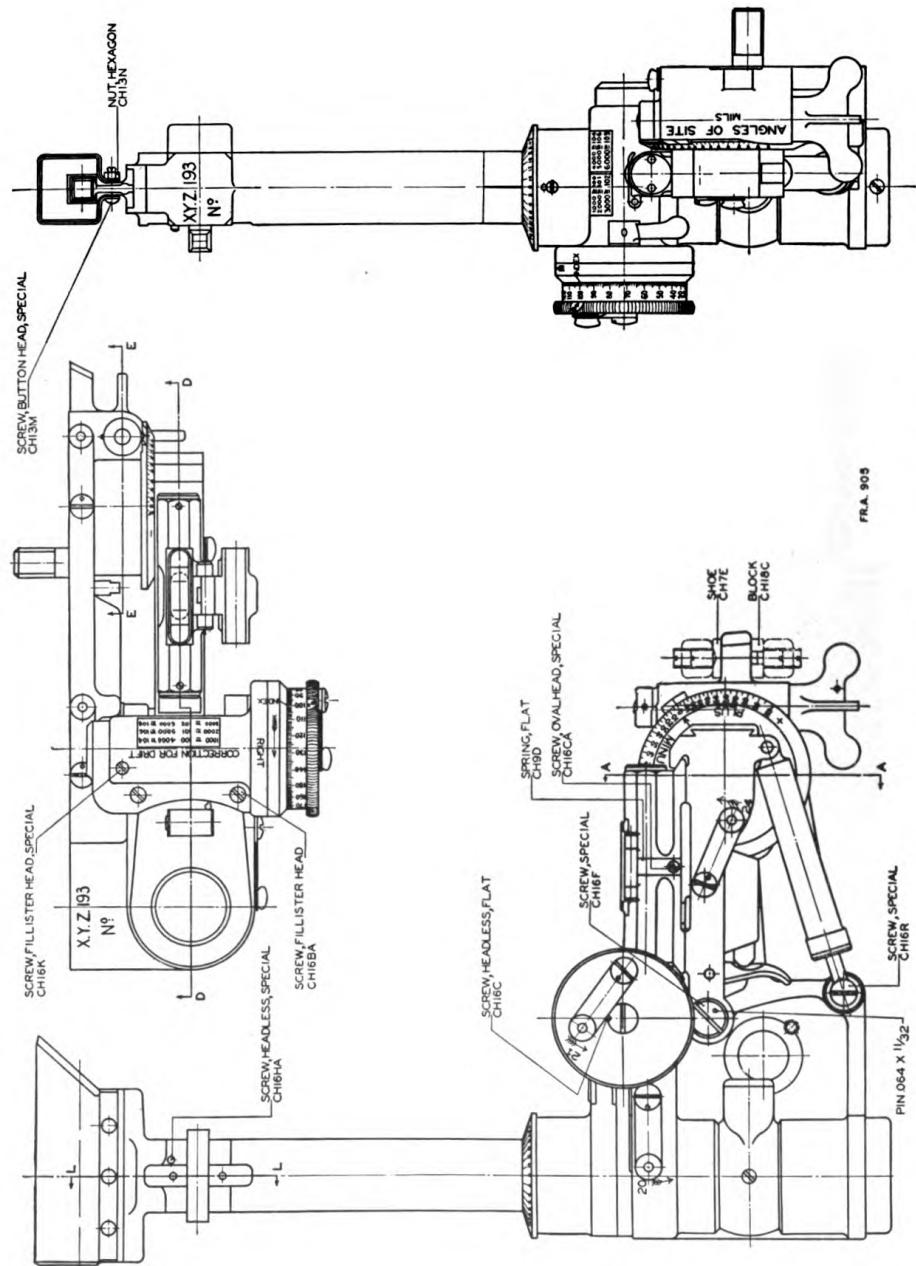


FIGURE 2.—Sight, M1901 (French), assembled views.

tion rotation of 200 mils. The deflection scale, graduated from 0 to 200 in 1-mil steps, is engraved on the deflection knob. The deflection knob clamping lever, CH5K, is provided to prevent rotation of the deflection knob during firing.

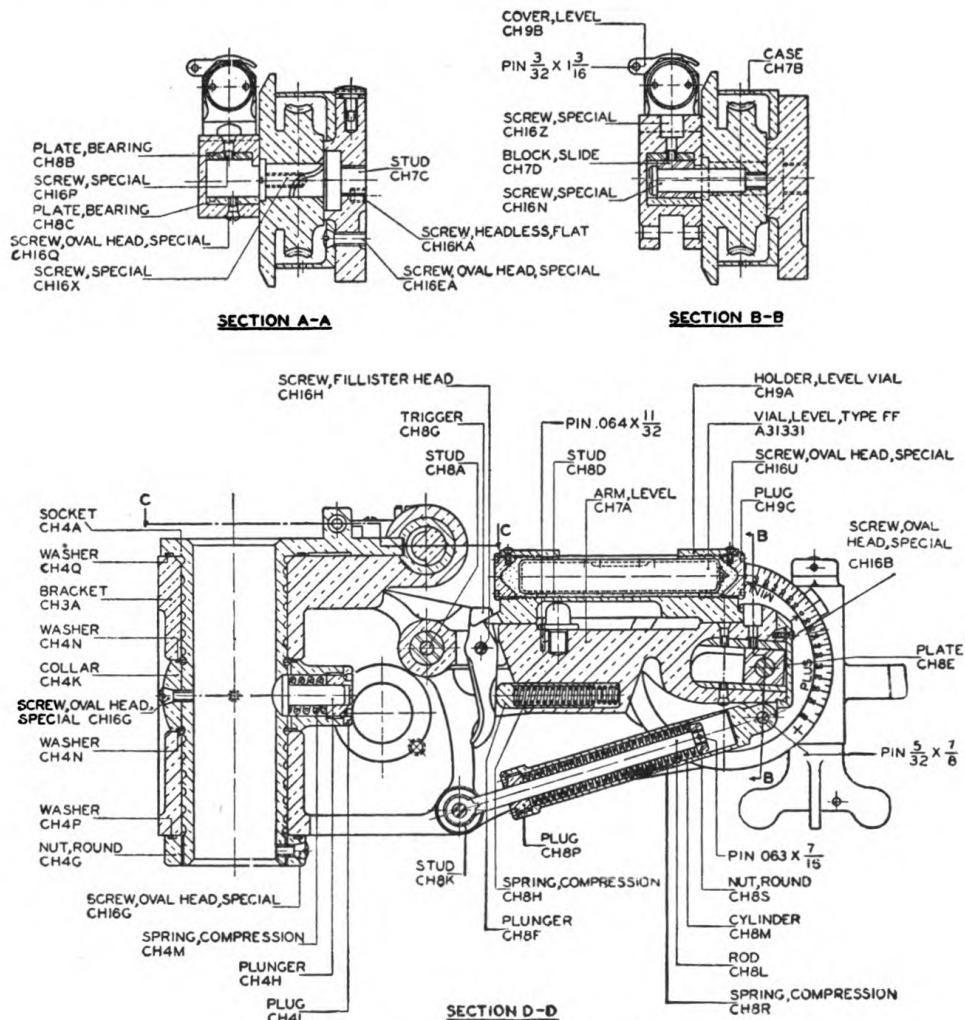
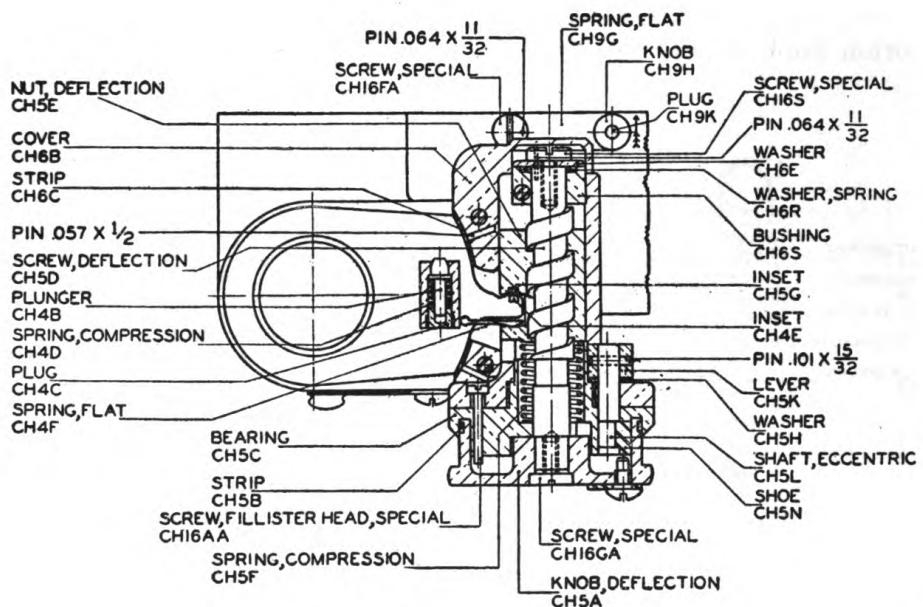
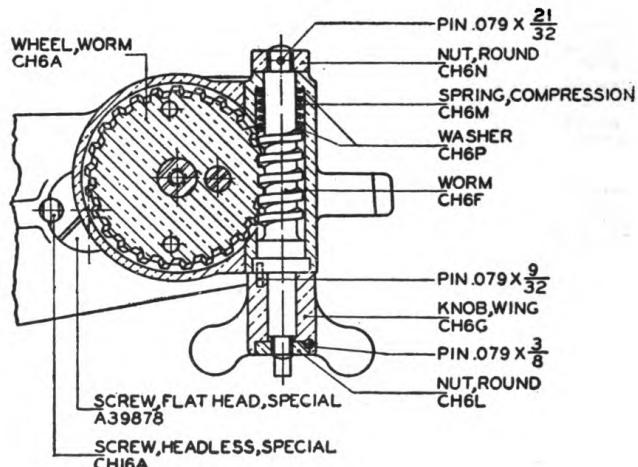


FIGURE 3.—Sight mount, sectioned views.

d. Angle of site settings are made by means of the angle of site worm wing knob, CH6G. This knob effects rotation of the angle of site worm wheel, CH6A, on which the angle of site scale is engraved, and by means of a special screw, CH16N, eccentrically located on the worm gear, raises or lowers the angle of site level arm, CH7A.



SECTION C-C



SECTION E-E

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FIGURE 3.—Sight mount, sectioned views—Continued.

e. The angle of site level assembly (fig. 4) fits on the level arm and is held in position by an angle of site level arm trigger, CH8G, which is spring controlled. The angle of site level assembly may be

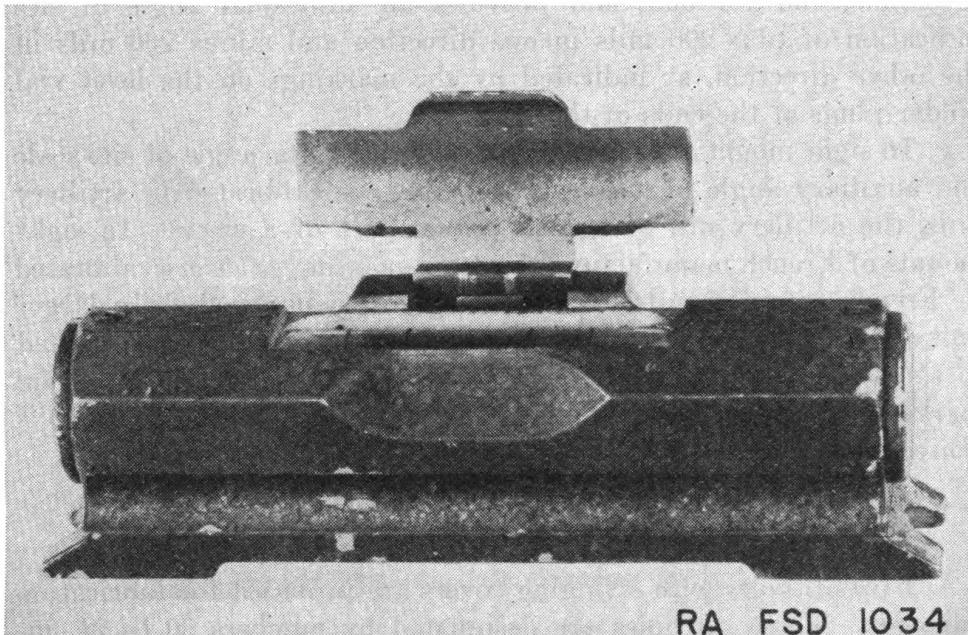


FIGURE 4.—Angle of site level, assembly.

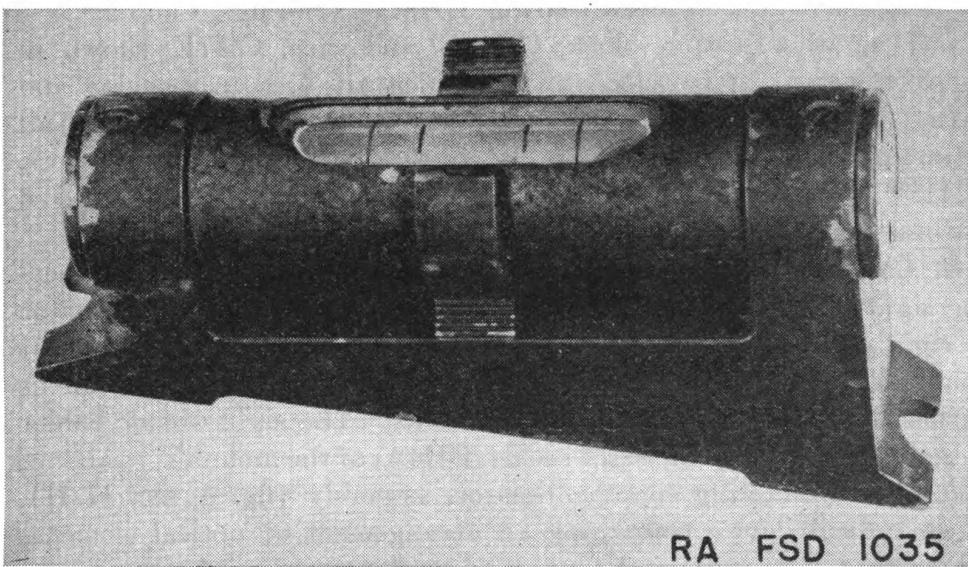


FIGURE 5.—Auxiliary angle of site level, assembly.

removed from the level arm by pressing on the trigger and disengaging the level from its seat. An angle of site level arm stud, CH8D, prevents end for end reversal of the angle of site level on the level arm.

f. The auxiliary angle of site level, assembly (fig. 5), interchangeable with the level described, has the feet of the level vial holder inclined 200 mils with the level vial axis. This level is reversible, end for end, and provides an additional angle of site indication of plus 200 mils in one direction and minus 200 mils in the other direction, as indicated by the markings on the level vial holder plugs at the ends of the level.

g. In sight mounts of American manufacture, the angle of site scale and auxiliary angle of site level assembly are calibrated in artillery mils, the artillery mil being the 1/6400 part of a circle. In sight mounts of French manufacture, the corresponding parts are calibrated in French infantry mils, this infantry mil being a slightly larger unit of angular measure. Sight mounts and levels are properly marked to show the source of manufacture, and the levels, in addition, are marked either "Artillery mils 11°15'" or "Infantry mils 11°27.53'." Conversion from either system to the other is as follows:

200 artillery mils = 196.4 infantry mils.

200 infantry mils = 203.7 artillery mils.

h. Five oil holes with swinging covers are provided for lubrication purposes. These oil holes are designated by numbers 20 to 24, inclusive. Oil hole 21 in the deflection knob provides access to two oil holes in the deflection screw bearing, CH5C. (See figs. 1 and 2.)

i. The tail adjusting block, CH18C, and shoe, CH7E, shown in figure 2 consist of two loose pieces which are used in securing and fitting the sight mount to the rocker arm of the gun carriage. Tail adjusting blocks are available in thicknesses of 4½ millimeters, CH18F; 5 millimeters, CH18E; 5½ millimeters, CH18D; and 6 millimeters, CH18C. The shoe, CH7E, is 3 millimeters thick.

6. Collimating sight.—*a.* The sighting element of the collimating sight is the collimating sight collimator (fig. 6). This collimator is rigidly secured to the top of the sight shank, CH11A. The sight shank is supported in the sight shank holder, C7731B, and can be turned about its axis in steps of 200 mils. The sight shank holder is designed to fit into the sight socket, CH4A, of the mount.

b. The collimating sight collimator, assembly (fig. 6, sec. H-H), is an optical device containing an arrangement of optical elements which focuses at infinity the image of the intersection of a horizontal and a vertical line. The two lines form a cross which is alined on a distant object by sighting along the outside of the collimator and glancing alternately at the distant object and through the collimator.

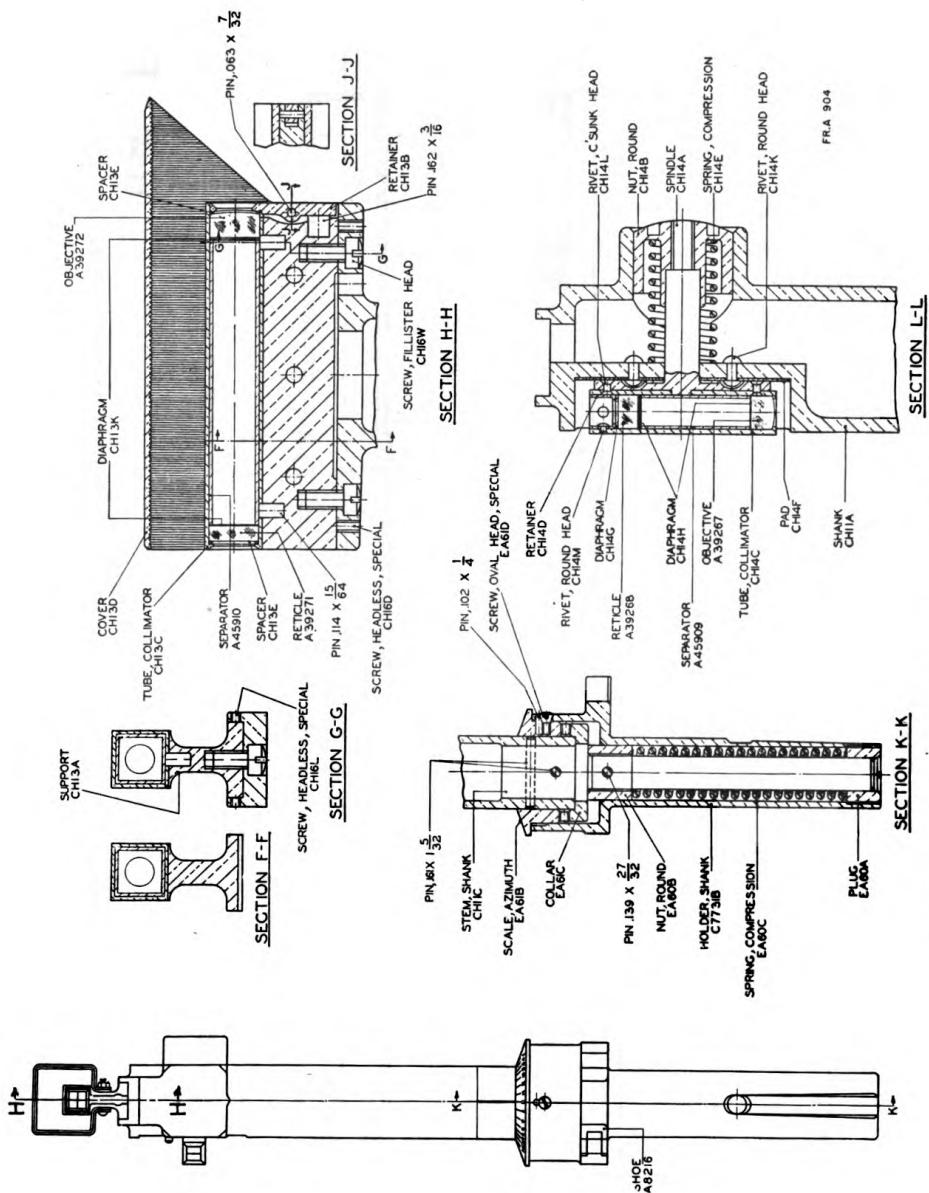


FIGURE 6.—Collimating sight, assembled and sectioned views.

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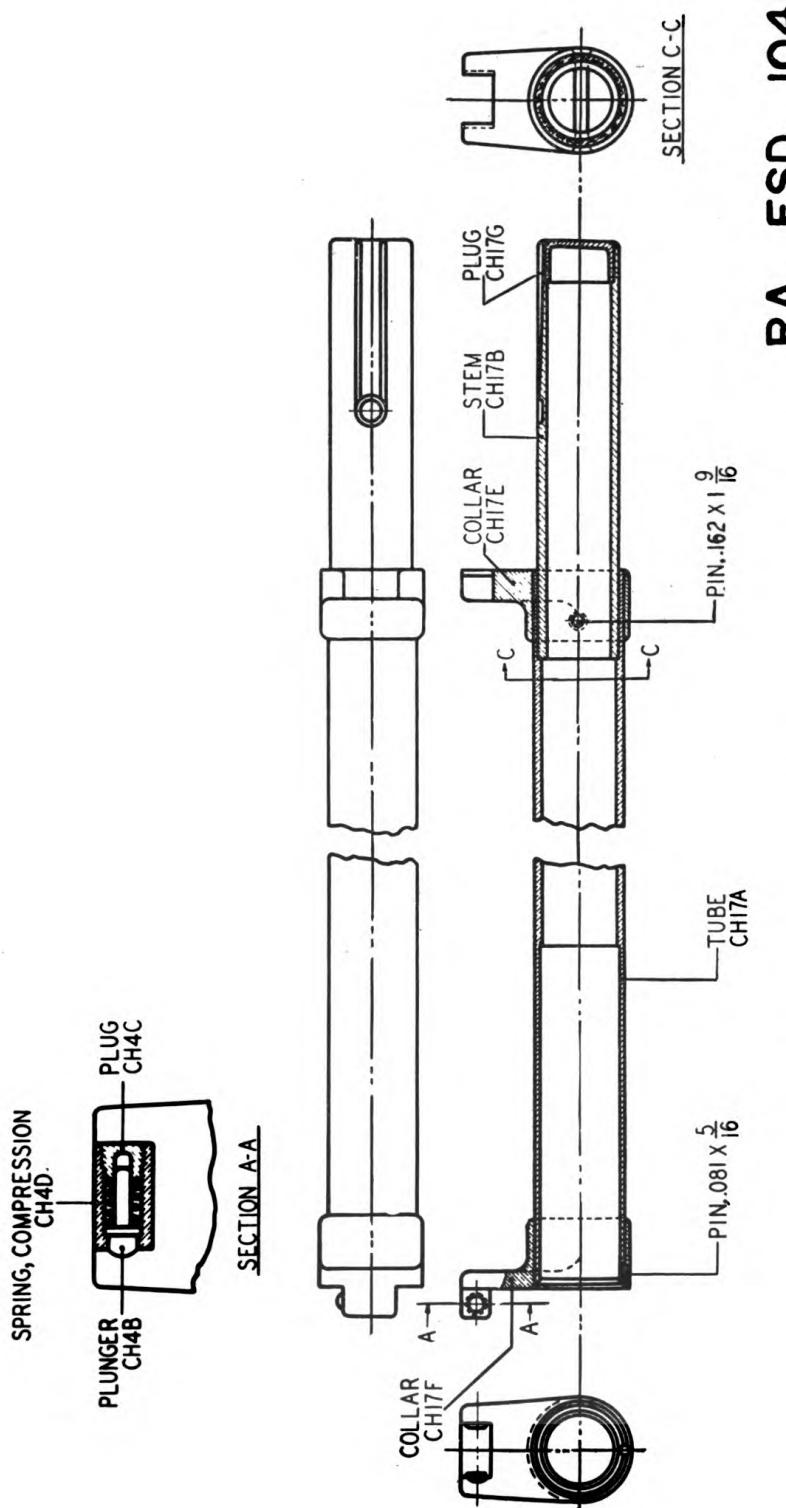


FIGURE 7.—Sight extension, assembly—assembled and sectioned views.

The collimating sight collimator cover, CH13D, which surrounds the collimator, protects the collimator from injury and confines the field of vision to permit accurate sighting.

c. The auxiliary collimator assembly is mounted on a spring biased spindle, CH14A, in the upper portion of the sight shank, CH11A. It can be brought into the operating position, as shown in figure 2, or retracted into the sight shank, as in figure 6, section L-L. This auxiliary collimator is used as a finder and is similar to the collimating sight collimator except that the image is a vertical line instead of a cross.

d. Azimuth settings by steps of 200 mils are applied by pressing down on the sight shank, CH11A, and rotating it until the index line on the shank is opposite the desired setting on the azimuth scale, EA61B. The compression spring, EA60C, within the sight shank holder, C7731B, returns the shank to position, and forces the teeth of the sight shank collar, EA61C, into engagement with the teeth on the azimuth scale, thus preventing disturbance of the setting during firing.

e. The lower portion of the sight shank holder, C7731B, seats into the sight socket, CH4A, of the sight mount. It is held against rotation within the socket by a forked portion embracing a lug on the top of the sight socket.

f. The sight extension, assembly (fig. 7), provided with the collimating sight is used to raise the collimating sight to a sufficient height for sighting over the carriage shield. The collimating sight fits into the upper end of the sight extension tube, CH17A, and is alined by the upper sight extension collar, CH17F. The sight extension stem, CH17B, fits into the sight socket of the sight mount and is alined by the lower collar. The sight extension must be removed from the sight mount when the piece is fired or when traveling.

SECTION III OPERATION

Procedure _____ Paragraph _____ 7

7. Procedure.—*a.* To place the sight in service, remove the canvas or leather cover from the sight mount, uncover the level, and remove the collimating sight from the carrying case and place in the socket of the sight mount, taking care that the forked projecting arm properly engages the mating parts. Withdraw the auxiliary collimator from its recess and turn it to the position shown in figure 2.

b. Azimuth or deflection settings are made in two steps:

(1) *Coarse* settings are made on the azimuth scale (referred to as the plateau) which is arranged to be set and read in steps of 200 mils. To make this setting, press down on the shank until it is free to rotate, then turn it so as to bring the index line thereon to the desired graduation on the azimuth scale and release. Be certain that the proper quadrant is used when making azimuth settings, as four positions with the same angular indication are possible.

(2) *Fine* settings are made using the deflection knob and the associated scale (referred to as the drum). The deflection scale is graduated in mils from 0 to 200 and is read against the index line on the deflection screw bearing; the 100 graduation is the normal setting. The clamping lever must be tightened after setting to prevent shifting of the setting during firing.

(3) The value of the setting is the sum of the fine and coarse (drum and plateau) settings.

(4) Note that a reading of 100 on the deflection scale corresponds to zero deflection angle.

(5) Increasing deflections (knob turned toward breech) on this scale displace the trajectory toward the left; decreasing deflections (knob turned toward muzzle) displace it toward the right.

c. Angle of site settings are required only when the piece is to be laid in angle of site (indirect fire).

(1) For angles numerically less than plus or minus 100 mils use the angle of site level; for larger angles, up to plus or minus 300 mils, remove the angle of site level and substitute the auxiliary angle of site level. When the auxiliary angle of site level is placed with the +200 inscription toward the rear, add 200 mils to scale indications; when it is placed with the -200 inscription toward the rear, subtract 200 mils from scale indications.

(2) To set angle of site, rotate the angle of site worm wing knob until the desired indication of the angle of site scale registers with the index line on the sight bracket. If the auxiliary level is used, add or subtract 200 mils as noted above. Plus angles of site are for target above the piece; minus angles are for target below the piece; a zero indication corresponds to a level line of sight.

d. To use the collimating sight collimator, place the eye approximately 10 inches to the rear of the collimator and move the eye so that the target is seen by the upper half of the pupil of the eye and the reticle cross by the lower half. When the axis of the collimator is alined on the target, the cross and the target will appear super-

posed. To assist in obtaining a preliminary alinement, use the auxiliary collimator as a finder.

e. When using either the angle of site or elevating handwheel of the gun carriage, make the last motion of the setting in the direction which elevates the breech end of the gun (depresses the muzzle). The object of this is to take up all lost motion and friction in one direction.

f. The sight extension is to be used only when vision is obscured by the shield or other carriage part. It must be removed before the piece is fired or moved. It may be readily installed by lifting the collimating sight from the sight mount socket, inserting the extension in that socket and the collimating sight in the similar socket in the extension, taking care that the forked projecting arms properly engage with the mating parts.

g. To prepare the sight for traveling, turn the auxiliary collimator to a vertical position and allow it to retract in the recess provided; remove the collimating sight and place it in the carrying case; cover the level and place the canvas or leather cover over the sight mount.

SECTION IV

INSPECTION AND ADJUSTMENT

	Paragraph
Tools for inspection.....	8
Inspection.....	9
Errors.....	10
Tests and adjustments.....	11
Recapitulation.....	12

8. Tools for inspection.—*a.* The sight testing tools chest (figs. 8 and 9) issued to ordnance maintenance companies for use in inspection of this matériel contains the following tools:

<i>Quantity</i>	<i>Items</i>
2	Glass, magnifying.
1	Guide, scribing, angle of site index.
1	Guide, scribing, deflection drum index.
1	Level, master.
2	Scriber.
1	Seat, testing, auxiliary level (French, 11°27'32'').
1	Seat, testing, auxiliary level (American, 11°15').
1	Seat, testing, level.
1	Seat, testing, sight.
4	Shield, protection.
1	Sight, service, master.
1	Sight, test, master.

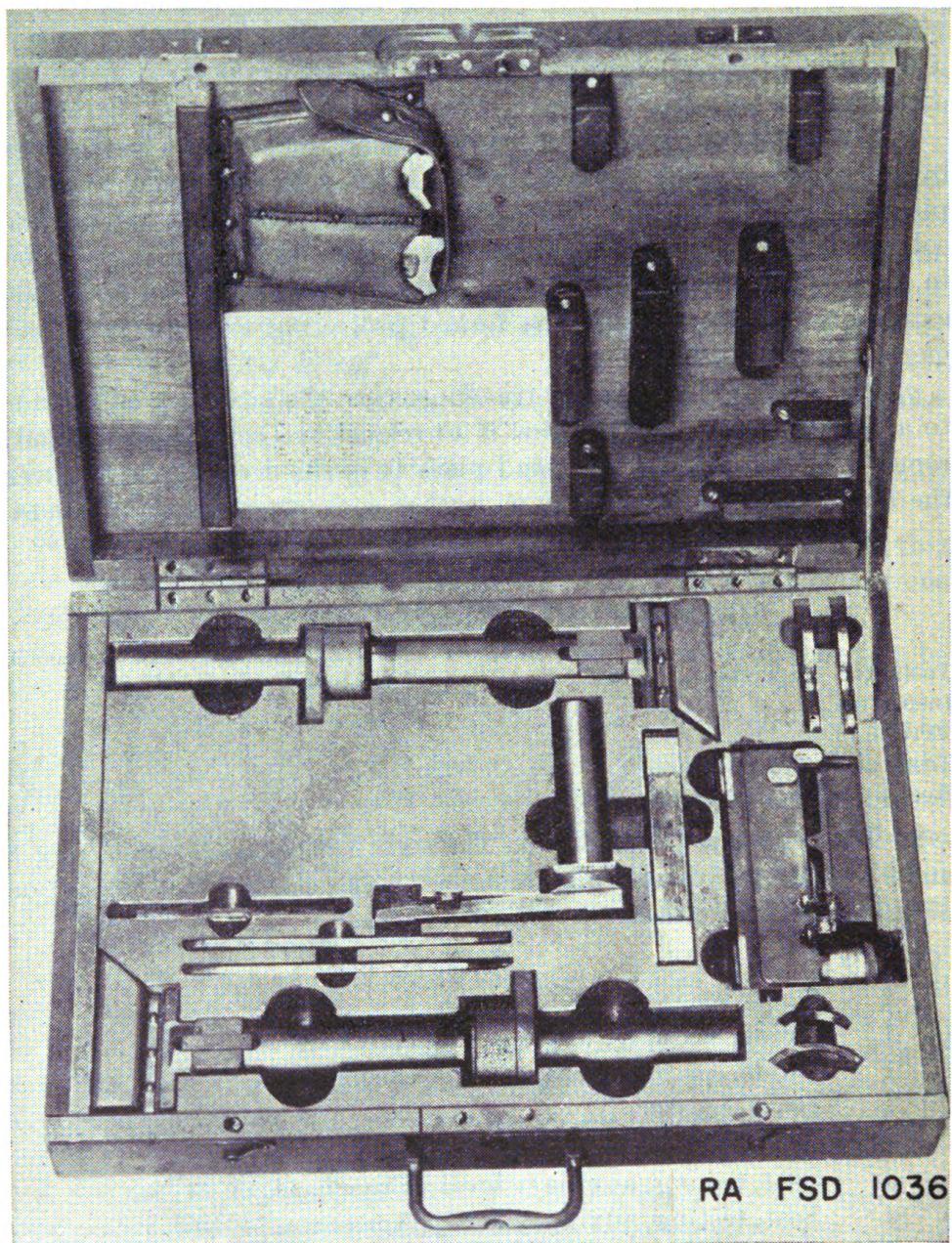


FIGURE 8.—Sight testing tools chest with contents.

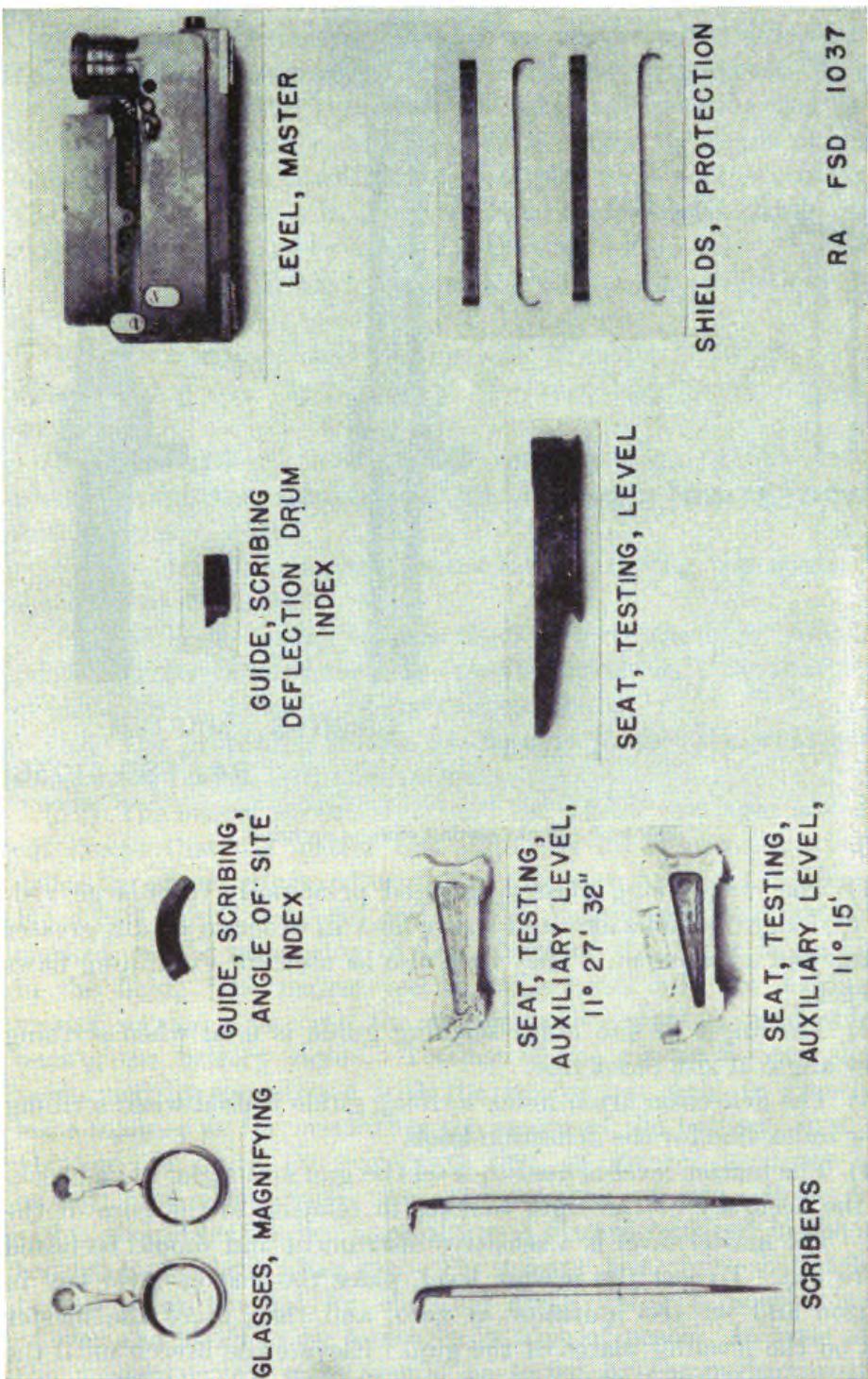


FIGURE 9.—Sight testing tools.

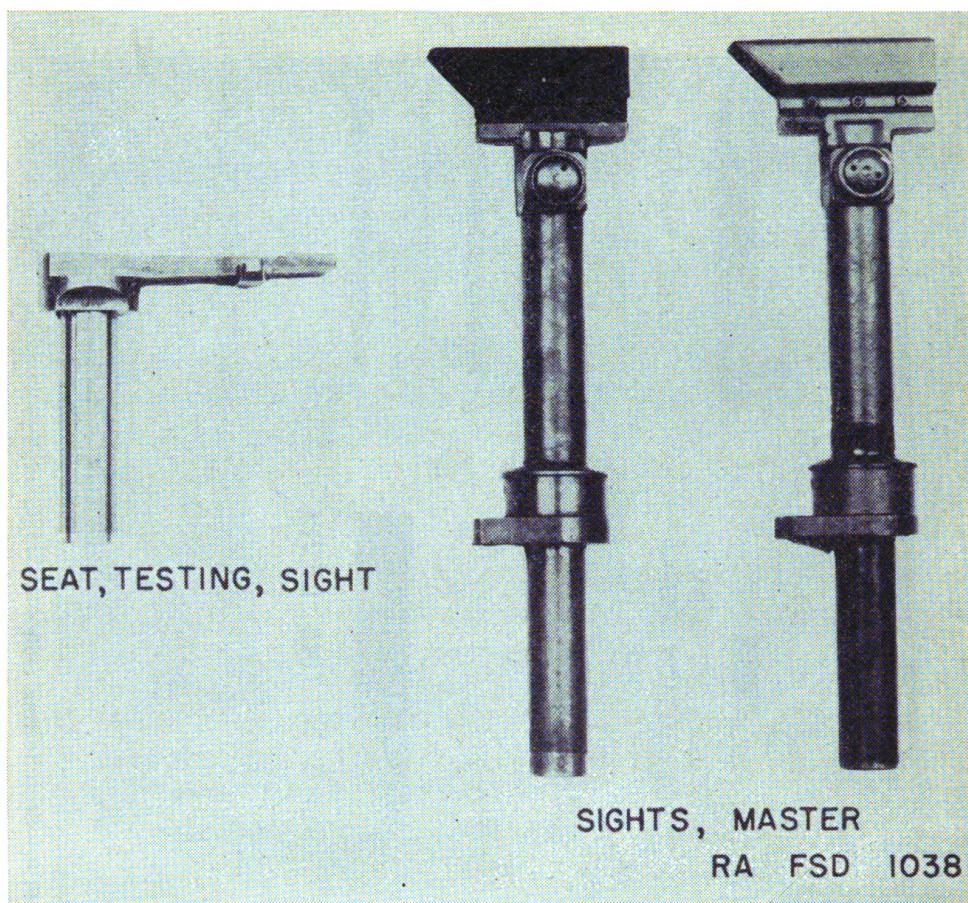


FIGURE 9.—Sight testing tools—Continued.

(1) The magnifying glasses are used principally to enlarge visibility of sight graduations and index lines in order to obtain greater accuracy in adjustment. They may also be used for examining flaws or cracks.

(2) The angle of site index scribing guide is used when scribing a new angle of site index line.

(3) The deflection drum index scribing guide is used when scribing a new index line for the deflection knob.

(4) The master level is used to level the gun and sight when checking the accuracy of the sight bracket in relation to the bore of the gun. The master level is a sensitive instrument and should be tested before use. To test the master level, place the master level key in position and set the indicator at zero, and then place the master level on the leveling plates of the gun. Elevate the breech until the bubble is centered between the lines on the level vial. Turn the master level end for end. If the level is properly adjusted, the

bubble will still be centered. If not, center the bubble by means of the indicator. The reading of the indicator is twice the error of the level, and if it exceeds $\frac{1}{4}$ of a minute the level should be adjusted. To adjust the master level, set the indicator at one-half the error noted and center the bubble of the level by elevating the breech. Set the indicator at zero and center the bubble by means of the adjusting screw. The master level will then be in proper adjustment. The adjusting screw is in a recess in the level foot directly under the indicator and is locked by a screw in the end of the level.

(5) The scriber is used for scribing new angle of site and deflection knob index lines.

(6) The auxiliary level testing seat (French, $11^{\circ}27'32''$) is used when testing the accuracy of the auxiliary level of French manufacture.

(7) The auxiliary level testing seat (American, $11^{\circ}15'$) is used when testing the accuracy of the auxiliary level of American manufacture.

(8) The level testing seat is used when testing the accuracy of the angle of site level.

(9) The sight testing seat is used to level the sight bracket in relation to the bore of the gun (previously leveled) for the purpose of checking the accuracy of sight adjustments.

(10) The protection shields are used to protect the scale graduations while removing the index line.

(11) The master service sight and the master test sight are identical except that the master test sight has its known elevation and deflection errors engraved on it for reference purposes. (Example: $E=+0.07$ min., $D=-0.0$ mil.) The master service sight is unmarked, as the measuring of the errors of this sight is performed in the field. The master test sight is used only for testing the master service sight, and the master service sight is used only for testing the battery sights. Testing of the master service sight is performed by comparison with the master test sight in exactly the same manner as for measuring the errors of the battery sight (par. 11c and d), with the exception that as greater accuracy is required, nine comparisons are made instead of five. Both master sights should be handled carefully and always replaced in the sight-testing tools chest after use. The master test sight should be returned to an arsenal for checking about every 3 months in time of war and about every 6 months in time of peace. In time of war the master service sight should be tested by comparison with the master test sight about every 2 weeks. In time of peace this comparison should be made each time before use.

b. A bore sight is used to indicate the direction of the axis of the bore of the gun for alinement and verification of the sights. Each bore sight consists of a breech bore sight and a muzzle bore sight. The breech bore sight (fig. 10) is a disk which fits accurately

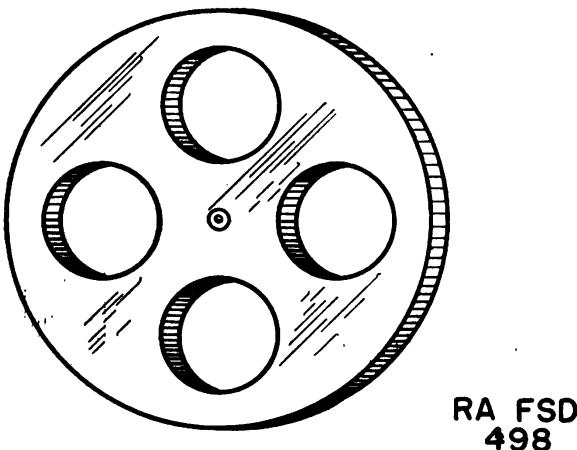


FIGURE 10.—Breech bore sight.

in the breech chamber of the gun; the model of the gun with which it is to be used is engraved on the disk. The muzzle bore sight comprises a quantity of black linen cord, to be stretched tightly across the muzzle, vertically and horizontally in the score marks thereon, and a web belt to be buckled around the muzzle to hold the cord in place.

c. A paper testing target (fig. 11) is used in testing and adjusting the sights. The portion of the target marked "Panoramic sight, M1917" is not used.

9. **Inspection.**—Inspection is for the purpose of determining the condition of the instrument and particularly whether repairs or adjustments are required to insure serviceability and proper functioning.

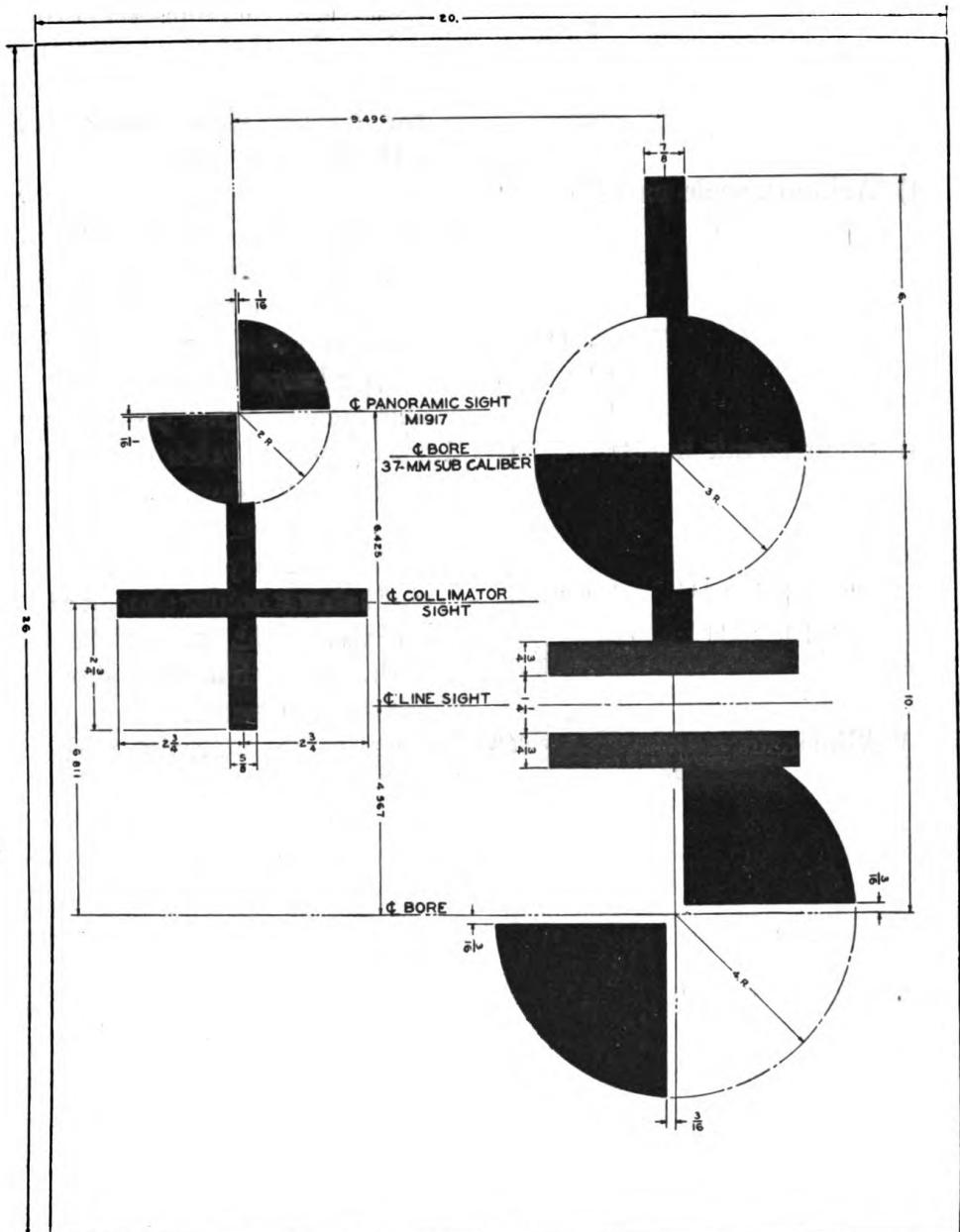
a. *Collimating sight* (see fig. 6).

Points to be inspected

- (1) General appearance.
- (2) Collimating sight col- limator.

Procedure

- (1) Note bent or missing parts. See that the azimuth scale markings and the index line on the sight shank are well defined.
- (2) See that the collimator is secure in its mounting, that the collimator cross is well defined, and that there are no bright spots or obstructions in the immediate field of vision.



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FIGURE 11.—Testing target.

Points to be inspected

(3) Auxiliary collimator.

(4) Azimuth scale parts.

(5) Sight shank holder.

(6) Alinement.

Procedure

(3) Operate the collimator in its mounting to see that the retracting device functions properly. See that the collimator line is well defined and that the leather sight shank pad, CH14F, is in place.

(4) Operate the collimating sight, setting it to several different azimuth positions. Note that the parts do not bind at any point and that the compression spring keeps the parts in firm engagement after positioning.

(5) Inspect the cylindrical locating surface for cleanliness and freedom from burs, nicks, dents, etc. Similarly, inspect the sight shank holder shoe, A8216, on the sight shank holder fork. See that the shoe is securely fastened.

(6) Determine the elevation and deflection errors of the collimating sight by comparison with the master service sight. Five comparisons are required. Allowable limits of error are plus or minus 3 minutes in elevation, and plus or minus 2 mils in deflection. The auxiliary collimator line of sight should agree within approximately 10 mils.

*b. Sight mount (see figs. 2 and 3).**Points to be inspected*

(1) General appearance.

Procedure

(1) Note bent or missing parts. See that the five oil hole covers operate properly and that the oil holes are not clogged. See that deflection scale and angle of site scale markings are well defined.

Points to be inspected

(2) Deflection parts.

(3) Sight socket.

(4) Angle of site level arm. (4)

(5) Angle of site scale index (5)

line. See that the scribed angle of site scale index line is within the limit indicated by the reference line on the bracket.

(6) Alinement.

Procedure

(2) Turn the deflection knob to its limit in each direction. There should be no binding at any point. The deflection knob clamping lever should be operable to secure the deflection knob from movement. Test for lost motion of the deflection knob. The maximum allowable lost motion is 4 mils.

(3) Inspect the locating surfaces of the socket and of the lug on top portion of socket for cleanliness and freedom from burs, nicks, dents, etc. See that the plungers, CH4B and CH4H, operate properly.

(4) Inspect the level seats for cleanliness and freedom from burs, nicks, dents, etc. See that the angle of site level arm trigger, CH8G, functions properly. See that the angle of site level arm cylinder assembly operates smoothly and exerts sufficient pressure over the entire range of travel.

(5) See that the scribed angle of site scale index line is within the limit indicated by the reference line on the bracket.

(6) Place the sight mount in a test fixture or similar firm support and place the sight testing seat in the sight socket. Level the sight mount by use of the master level on the sight testing seat. Place the level testing seat in position on the angle of site level arm, and again using the master level, determine the error (departure

*Points to be inspected**Procedure*

from horizontal) of the angle of site level arm when the angle of site scale is set to read zero. Allowance should be made for any inaccuracy of the level testing seat or sight testing seat. The maximum permissible error is 6 minutes.

*c. Angle of site level and auxiliary angle of site level (see fig. 3).**Points to be inspected**Procedure*

- (1) General appearance. (1) See that the level holder feet are smooth and free from nicks or other flaws which would affect the accuracy of the level, and that the level vial cover operates properly.
- (2) Level vial. (2) See that the level vial is not broken and that it is securely held in its mounting.
- (3) Level vial alinement. (3) Determine the error of the angle of site level by comparison with the master level. An error not in excess of plus or minus 2 minutes is permissible.

*d. Sight extension (see fig. 7).**Points to be observed**Procedure*

- (1) General appearance. (1) Note bent or missing parts. Note any burs or dents on the sight extension stem, CH17B, or in the socket of the sight extension tube, CH17A. See that the plunger, CH4B, operates properly.
- (2) Alinement. (2) Place the collimating sight in the sight mount and sight on a distant aiming point. Compare the setting when using the sight extension.

10. Errors.—*a. Sight errors.*—Due to inaccuracies in manufacturing and to other causes, the sights and levels generally possess inherent errors which cannot be removed but which can be compensated

for if within certain limits. These are errors in elevation and deflection and must be known in order to be able to adjust the sight to the gun. They are determined by comparison with the master service sight, the errors of which are known.

(1) The error of a sight, the line of which points too high, is expressed with a minus (-) sign, as it causes the gun to point too low. Conversely, the error of a sight, the line of which points too low, is expressed with a plus (+) sign, as it causes the gun to point too high. These are the elevation errors and are expressed in minutes.

(2) If the sight line points to the left, it is expressed with the plus (+) sign because it causes the gun to point to the right. If the sight line points to the right, it is expressed with the minus (-) sign because it causes the gun to point to the left. These are deflection errors and are expressed in mils.

b. *Trunnion friction.*—Successive layings made with a gun having excessive trunnion friction may not be in agreement one with the other due to variation in the direction of motion by which they have been finished. Errors introduced in this manner are not due to misalignment of the sight. They can be minimized by always operating the elevating handwheel so as to raise the breech for the final setting.

(1) *To determine trunnion friction angle.*—Set the range scale at about 1,000 and the angle of site scale at zero. (These are the most convenient settings, but any settings may be used if they are not changed during the operation.) By means of the angle of site handwheel, raise the breech (it may be necessary first to lower and then raise) so as to bring the bubble of the angle of site level between its index lines without overpassing the position, that is, without having to lower the breech after having raised it. Place the master level on the leveling plates of the gun with the indicator to the rear, remove the master level key, set the indicator at zero, and turn the thumb nut so as to bring the bubble between the index lines. Leave the master level in place on the leveling plates. Raise the breech by two or three turns of the angle of site handwheel, then lower it slowly so as to bring the bubble of the angle of site level between its index lines without overpassing the position. Turn the indicator of the master level without touching the thumb nut, and bring the bubble between its index lines. Take the reading of the indicator. The angle, or the reading of the indicator, so found is the measure of the trunnion friction.

(2) *Correcting for trunnion friction.*—The trunnion friction should be reduced to as low a value as possible before attempting to aline the sights. Alinement should not be attempted if the angle found as the measure of trunnion friction is in excess of 3 minutes. The method of correcting for trunnion friction is described in TM 9-1305 (now published as TR 1405-75A).

11. **Tests and adjustments.**—*a.* Set up the testing target approximately 54 yards from the gun; have the target level with the gun and true with a plumb line. Remove the left shield and the sight shield of the gun. With the gun pointed in the direction of the target, level the axle, jacking up one wheel if necessary. The wheels should be on hard ground or other firm base. Place the gun in the center of the cradle, using the following method: Place a screw driver between the side of the recoil mechanism and the sweeper plate and pry the gun as far to one side as it will go, then back as far as it will go to the other side, then to the center of the two extreme positions.

b. Test the sight mount for lost motion of the deflection knob, as follows:

(1) With either the master service sight or the collimating sight in the sight mount, bring the vertical line of the sight to the corresponding line on the testing target by revolving the deflection knob from zero. Note the reading on the deflection scale.

(2) Rotate the deflection knob until the 200 division is reached, then in the opposite direction until the vertical line of the sight again rests on its line on the testing target. As before, note the reading on the deflection scale.

(3) The difference between the two readings represents the lost motion of the deflection knob. If the lost motion exceeds 4 mils the sight mount cannot be used.

c. Determine the deflection error of the battery collimating sight by comparison with the master service sight, as follows:

(1) Place the master service sight in the sight mount and set the deflection knob at 100 by rotating from 0 to 100 without passing the index line. Lay the sight on its corresponding target of the testing target by means of the traversing handwheel. This marks the position of the master service sight.

(2) Remove the master service sight, put in place the battery sight, and again bring the sight on its target by rotating the deflection knob from 0 to the setting which brings the sight on the target without overpassing the setting. (Do not operate the traversing handwheel.) Take the reading of the deflection knob and record it.

(3) Repeat the operation with the two sights five times, recording each reading. Determine the mean reading. Record the difference between the mean reading and 100, using the minus (−) sign if the figure is below 100 and the plus (+) sign if the figure is greater than 100. For example, if the mean reading is 98 mils the value to be recorded is −2 mils. The result is the relative deflection error of the battery sight with respect to the master service sight.

(4) To get the absolute error of the battery sight, the known error of the master service sight must be added algebraically. (Rule for adding two algebraic numbers: If the numbers have like signs, find the sum of their absolute values and prefix the common sign to the result; if the numbers have unlike signs, find the difference of their absolute values and prefix the sign of the greater number to the result.)

(5) An error not in excess of plus or minus 2 mils (± 2) is permissible.

d. Determine the elevation error of the battery collimating sight by comparison with the master service sight, as follows:

(1) Place the master service sight in the sight mount. Set the angle of site scale to read zero; set the deflection knob at 100 (with azimuth plateau scale at zero) and bring the horizontal line of the sight to the corresponding line on the testing target by elevating the breech with the angle of site handwheel. Remove the angle of site level and in its place attach the level testing seat. Set the indicator of the master level at zero and place the master level on the level testing seat with the indicator to the rear. Center the bubble of the master level by means of the angle of site worm wing knob. This marks the position of the master service sight.

(2) Remove the master service sight, put in place the battery sight, and again bring the sight on its target by elevating the breech with the angle of site handwheel. Center the bubble of the master level by means of the indicator. (Do not change the setting of the angle of site worm wing knob.) Take the reading of the indicator and record it with its sign. This is the first of a series of readings which will give the relative error of the battery sight with respect to the master service sight.

(3) Repeat the operation with the two sights five times, recording each reading. The mean of the five readings will give the relative error of the battery sight. However, the master service sight has an error, and to get the absolute error of the battery sight this error must be added to it algebraically. For example, if the known error of the master service sight is $+0.2'$, and the relative error of the

battery sight is $-0.3'$, the absolute error of the battery sight is $-0.1'$.

(4) An error not in excess of plus or minus 3 minutes ($\pm 3'$) is permissible.

e. Determine the error of the angle of site level, as follows:

(1) Place the level testing seat (fig. 9) on the leveling plates of the gun. Place the angle of site level on the level testing seat with the cover open to the left, as this is the position in which the level sets on the sight bracket. Center the bubble of the angle of site level by means of the angle of site handwheel.

(2) Remove the angle of site level and level testing seat. With the master level key in place, set the master level (fig. 9 ①) on the leveling plates of the gun with the indicator to the rear. Center the bubble of the master level by means of the indicator. The reading of the indicator with its sign will be the error of the angle of site level.

(3) An error not in excess of plus or minus 2 minutes ($\pm 2'$) is permissible.

f. Determine the error of the auxiliary angle of site level. The procedure for determining the error of either the auxiliary angle of site level of French manufacture ($11^{\circ}27'32''$) or the auxiliary angle of site level of American manufacture ($11^{\circ}15'$) is the same except that the corresponding auxiliary level testing seat is used for either level.

(1) Place the proper auxiliary level testing seat on the leveling plates of the gun. Place the proper auxiliary angle of site level on the auxiliary level testing seat in the same position in which it sets on the sight bracket. Center the bubble of the auxiliary angle of site level by means of the angle of site handwheel.

(2) Remove the auxiliary angle of site level and the auxiliary level testing seat. Place the master level, with master level key in place, on the leveling plates of the gun with the indicator to the rear. Center the bubble of the master level by means of the indicator. The reading of the indicator with its sign will be the error of the auxiliary angle of site level.

(3) An error not in excess of plus or minus 2 minutes ($\pm 2'$) is permissible.

g. The limits of absolute elevation errors allowed are—

For the collimating sight, plus or minus 3 minutes ($\pm 3'$).

For the angle of site level, plus or minus 2 minutes ($\pm 2'$).

However, the algebraic difference between these errors must not be too large, as it will then be impossible to bring readings made with the

collimating sight and with the angle of site level into proper agreement. The maximum permissible difference is 3 minutes (3'). (Rule for obtaining the algebraic difference of two numbers: If the numbers have unlike signs, add the two numbers; if the numbers have like signs, subtract the smaller number from the larger. In this case, the sign of the result may be disregarded.)

(1) Determine the algebraic difference between the previously determined absolute errors of the collimating sight and angle of site level, as explained above.

(2) If the difference is in excess of 3 minutes (3') substitute another collimating sight or angle of site level on hand to bring the difference within the specified limit. It will then be necessary to redetermine such errors as are affected by the substitution.

h. If the deflection error of the collimating sight and the backlash of the deflection knob are within the permissible limits, proceed with the adjustment of the sight. Due to the construction of the sight mount, correction for errors in deflection can be made only by shifting the position of the index line on the deflection screw bearing, as follows:

(1) With the bore sights and testing target in position, line on the bore sight target by means of the traversing and elevating hand-wheels.

(2) Place the master service sight in the sight bracket. Bring the vertical line of the collimating sight collimator on its corresponding line of the testing target by revolving the deflection knob from zero. If the setting is passed, return the deflection knob to zero and repeat the operation.

(3) Using the deflection drum index scribing guide, draw a sharp pencil line on the deflection screw bearing opposite the 100 division of the deflection knob. If this line is so close to the line already scribed as to make the operation inconvenient, draw the line opposite the 50 division.

(4) Using the pencil line as a temporary index, reset the deflection knob so as to eliminate the known deflection error of the master service sight. For example, if the pencil line was drawn opposite the 50 division, and if the known deflection error of the master service sight is plus 2 mils (+2), the setting of the deflection knob should be 48 mils; if the known deflection error of the master service sight is minus 2 mils (-2), the setting of the deflection knob should be 52 mils. The position of the 100 graduation then indicates the position of the index line. However, do not scribe this line permanently until the test for elevation has been made, as that test may show that the sight

mount will have to be changed. After the test for elevation is made, if it is found that the sight mount can be used, the line must be permanently scribed.

i. Test the alignment of the angle of site level arm in the sight mount. This is done by determining the error of the angle of site level when mounted in the sight mount, and subtracting from this the error due to misalignment of the sight mount on the rocker arm of the gun.

(1) Test the alignment of the sight mount on the rocker arm of the gun by the following method:

(a) Place the battery collimating sight in the sight mount. With the bore sights and testing target in position as in the preceding tests, and with the range scale set to zero, lay the bore sights of the gun on the corresponding target of the testing target by elevating the breech with the angle of site handwheel. (If the target is passed, lower the breech and start again.)

(b) Place the master level on the leveling plates of the gun with the indicator to the rear. Remove the master level key and set the indicator at zero. Turn the thumb nut of the master level until the bubble is centered. Leave the master level on the leveling plates of the gun and lower the breech by two or three turns of the angle of site handwheel, then raise the breech until the horizontal line of the collimating sight collimator rests on its corresponding line of the testing target. (If the target is passed, lower the breech and start again.) Turn the indicator of the master level until the bubble is centered. Take the reading of the indicator and record it with its sign. This reading represents the error of the battery collimating sight when mounted in the sight mount.

(c) From the reading so obtained, subtract algebraically the error of the battery collimating sight (previously determined according to par. 11d). The result will be the error of the sight mount due to misalignment of the mount on the rocker arm. (Rule: Reverse the sign of the error of the battery collimating sight and then add the two numbers algebraically.) Record the error with its sign.

(2) Test the alignment of the angle of site level arm in the sight mount by the following method:

(a) Place the angle of site level on the angle of site level arm. With the gun and testing target in position as in the preceding tests, lay the bore sights of the gun on the corresponding target of the testing target by elevating the breech with the angle of site handwheel. (If the target is passed, lower the breech and start again.)

By means of the angle of site worm wing knob, set the angle of site scale to read zero.

(b) Place the master level on the leveling plates of the gun with the indicator to the rear. Remove the master level key and set the indicator at zero. Turn the thumb nut of the master level until the bubble is centered. Leave the master level on the leveling plates of the gun and lower the breech by two or three turns of the angle of site handwheel, then raise the breech until the bubble of the angle of site level is between its index lines. (If the bubble passes the central position lower the breech and start again.) Turn the indicator of the master level until the bubble is centered. Take the reading of the indicator and record it with its sign. This reading represents the error of the angle of site level when mounted in the sight mount.

(c) From the reading so obtained, subtract algebraically the error of the angle of site level (previously determined according to par. 11e). The result will be the error in angle of site level reading due to the sight mount. (Part of this error will be due to misalignment of the sight mount on the rocker arm, and the remainder will be due to misalignment of the angle of site level arm in the sight mount.) From this result subtract algebraically the error due to misalignment of the sight mount on the rocker arm (determined in (1) above). This latter result, with its sign, will be the error due to misalignment of the angle of site level arm in the sight mount.

(3) Due to the construction of the sight mount, correction for misalignment of the angle of site level arm in the sight mount can be made only by moving the angle of site index line so as to alter the zero setting of the angle of site scale. However, as the angle of site graduations are not equally spaced the index line can be displaced only within close limits, beyond which the readings made at some distance from the zero would be too inaccurate. The maximum permissible movement of the index line is 0.6 millimeter, as determined by the thickness (0.6 millimeter) of the reference line etched on the bracket to the rear of the index line. (The reference line is etched on the bracket by the manufacturer and must not be moved. Should a sight mount be received on which this line is not etched, the mount cannot be used.) Moving the index line 0.6 millimeter corresponds to an alteration of 3 minutes ($3'$) in the position of the level, hence 3 minutes is the maximum correction possible. (Should the index line originally be exactly in the middle of the reference line, a maximum correction of only $1\frac{1}{2}$ minutes will be possible.)

However, an additional correction of not more than 3 minutes can be introduced by altering the alinement of the sight mount on the rocker arm. (This can be done only if the elevation error of the collimating sight is in the opposite direction and if the resultant misalinement of the mount on the rocker arm does not exceed 3 minutes.) A sight mount having a misalinement of the level arm in excess of 6 minutes cannot be used.

j. Adjust the sight mount for alinement with the bore of the gun. The errors determined in the preceding tests will determine the amount and direction of adjustment necessary.

(1) Adjust the sight mount on the rocker arm for vertical alinement with the bore of the gun. The adjustment is made by altering the thickness of the tail adjusting block. This block is under the tailpiece of the sight bracket and rests on the bottom lug of the rocker arm. Tail adjusting blocks are available in thicknesses of $4\frac{1}{2}$, 5, $5\frac{1}{2}$, and 6 millimeters, respectively. A correction which is intended to elevate the gun means moving the tail of the bracket up by the use of a thicker block; to depress the gun means moving the tail of the bracket down by the use of a thinner block. A difference of 0.1 millimeter (0.04 inch) corresponds approximately to a difference of 2 minutes in the position of the bracket.

(a) Remove the collimating sight from the sight mount and place the sight testing seat in the sight socket. Place the master level, with master level key in position, on the sight testing seat, and set the indicator at zero. Center the bubble of the master level by means of the angle of site handwheel. (When fitting a new sight mount, an approximate selection of the block may be made at this point by first leveling the gun and then inserting the block which causes the master level to read nearest the horizontal.)

(b) Loosen slightly the upper adjusting screw in the rocker arm upper lug. Loosen the sight bracket clamping nut and the sight bracket center nut enough to allow the sight mount to be moved stiffly up and down.

(c) With the master level key in place, set the indicator of the master level to the value of the required correction. Place the master level on the sight testing seat and raise or lower the sight mount until the bubble is centered. The sight mount is correctly alined when in this position. Fit a tail adjusting block by filing down a block which is initially just a little too thick, testing it frequently by placing it in position under the tailpiece. When the correct thickness has been obtained, place the block in position,

tighten the upper adjusting screw, sight bracket clamping nut, and sight bracket center nut, and recheck with the master level.

(2) Adjust the sight mount to correct for misalignment of the angle of site level arm in the sight mount (determined in *i* above). This adjustment is made by moving the site scale index line. A correction which is intended to elevate the gun is made by moving the index line up; to depress the gun the index line is moved down.

(a) Set the angle of site scale exactly at zero. Remove the angle of site level from the level arm, and place on the level arm the level testing seat. Place the master level, with master level key in position, on the level testing seat, and set the indicator at zero. Center the bubble of the master level by means of the angle of site handwheel.

(b) Set the indicator of the master level to read the amount of the required correction, then level the bubble by means of the angle of site worm wing knob. This will place the zero line of the angle of site scale to the position where the new index line should be scribed. (Should the new position of the index line fall outside the reference line, the zero line should be brought to the extreme position within the limit. Leveling the master level by means of the indicator will then give the maximum position correction. If the amount of the correction still required is in excess of that which can be taken up by readjusting the sight mount on the rocker arm, the sight mount will have to be changed.)

k. The foregoing adjustments should always be followed by a complete new test with the sight mount tightly secured to the rocker arm.

12. Recapitulation.—*a.* Ascertain that the lost motion of the sight mount deflection knob is not in excess of 4 mils.

b. Determine the deflection error of the battery collimating sight. An error not in excess of plus or minus 2 mils is permissible.

c. Determine the elevation error of the battery collimating sight. An error not in excess of plus or minus 3 minutes is permissible.

d. Determine the error of the angle of site level and auxiliary angle of site level. An error not in excess of plus or minus 2 minutes is permissible.

e. The algebraic difference of elevation errors of the collimating sight and angle of site level should not exceed 3 minutes. If the difference is in excess of 3 minutes, substitute another collimating sight or angle of site level on hand to bring the difference within the specified limit.

f. Correct for deflection error of the sight mount by determining a position of the deflection index line which will cause the deflection knob to read 100 when the line of sight is parallel to the bore of the gun. In the procedure outlined, the known error of the collimating sight is made to cancel out. This avoids the necessity for changing the index line when substituting a new collimating sight, provided that the substitute sight is within the permissible error. A similar provision is made with regard to the elevation corrections.

g. Determine the elevation error of the sight mount due to misalignment of the sight mount on the rocker arm. Determine the elevation error of the angle of site level when mounted in the sight mount. From these determine the error due to misalignment of the angle of site level arm in the sight mount. Correct by scribing new angle of site index line within thickness limit of reference line on bracket.

h. Adjust the sight mount for alignment with the bore of the gun by use of a properly fitted tail adjusting block.

i. Recheck.

SECTION V

MAINTENANCE AND REPAIR

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13. Sight mount.—Partial disassembling of the sight mount may be required to permit cleaning of bearing surfaces or replacement of unserviceable parts. Complete disassembling is not ordinarily required. Representative operations are described below, but the method and extent of the operations may be changed if necessary to fit individual cases.

a. To disassemble sight socket, CH4A, and deflection screw parts.—

(1) Remove the deflection screw cover, CH6B, secured by two special fillister head screws, CH16BA.

(2) Remove the special screw, CH16S, from the end of the deflection screw after removing the 0.101 by $1\frac{1}{32}$ pin which secures it. Remove the two deflection screw washers, CH6E and CH6R.

(3) Remove the special fillister head screw, CH16K, which passes through the worm housing portion of the sight bracket and secures the deflection screw bushing, CH6S. Remove the bushing. This operation is required to permit disassembling of the sight socket, CH4A, and may be omitted if the deflection screw only is to be removed.

(4) To remove the sight socket, CH4A, remove the round nut, CH4G, and the screws and plunger which hold the sight socket collar, CH4K, in place. Operate the deflection knob, CH5A, until the tail of the sight socket is free of the deflection screw nut. Lift the sight socket out of its seat.

(5) To remove the deflection screw, CH5D, remove the special fillister head screw, CH16AA, which secures the deflection screw bearing, CH5C, and remove the deflection knob clamping lever eccentric shaft, CH5L. Unscrew the deflection screw bearing and remove it with the deflection screw and associated parts. Note that the deflection screw and deflection screw nut of an individual sight are fitted to each other as a matched pair, and therefore must not be interchanged separately with corresponding parts of another sight.

(6) The deflection screw parts may be further disassembled if required. Reference should be made to section C-C of figure 3.

b. To disassemble angle of site worm and level arm parts.—(1) Remove the special screw, CH16R, which secures the lower end of the level arm cylinder assembly, after driving out the pin which retains the screw in the stud, CH8K. The cylinder will then hang free during the succeeding operations and may be later removed by driving out the $\frac{5}{32}$ by $\frac{7}{8}$ pin in the upper end.

(2) Remove the round nut, CH6N, from the end of the angle of the site worm, CH6F, after driving out the 0.079 by $2\frac{1}{32}$ pin. Withdraw the angle of site worm, CH6F, with its knob.

(3) Remove the special oval head screw, CH16B, which secures the angle of site level arm end plate, CH8E, in its dovetail seat. Drive the end plate free from its seat.

(4) Remove the special oval head screw, CH16Q, which secures the angle of site lower bearing plate, CH8C, in the angle of site level arm. Pull out the lower bearing plate, using a screw driver in the bottom groove of the plate. Place a reference mark on the rear surface of the angle of site worm wheel slide block, CH7D.

(5) Remove the special screw, CH16F, from the end of the level holder stud, CH8A, after removing the 0.064 by $1\frac{1}{32}$ pin which secures it.

(6) Lift off the angle of site level arm, CH7A.

(7) To remove the angle of site worm wheel, CH6A, remove the special screw, CH16X, from the angle of site worm wheel stud, CH7C.

c. Reassembly.—Reassemble in the reverse order of disassembly. Clean and lubricate each part before reassembling. Parts requiring oil are to be lubricated with aircraft instrument and machine-gun

oil (U. S. A. Spec. 2-27). Parts requiring grease are to be lubricated with Royco 6A. Leather washers, where used, should be inspected and replaced, if necessary.

14. Collimating sight.—Repairs which necessitate disassembling and assembling operations are limited to those which do not affect the alignment of the collimating sight collimator. Only the operations shown below are permitted. Other repairs involving realignment, removal, or replacement of optical parts cannot be made with the facilities available and require that the sight be returned to the base shop.

a. To replace the compression spring, EA60C (fig. 6), in the sight shank holder, C7731B, it is necessary to remove the sight shank stem plug, EA60A, in the lower end of the sight shank holder. This plug is threaded to be a tight fit in the shank holder and is locked when assembled by peening over the thread of the shank holder. Lubricate the spring coils before assembling.

b. The collimating sight collimator cover may be replaced in case of damage, but extreme care must be exercised to prevent damage to the collimator or shifting of its position. The split ends of the special button head screws, CH13M, are clinched over the nuts after assembling.

c. In case of damage to the auxiliary collimator, replace with a new assembly. Stake the round nut, CH14B, to the spindle, CH14A, when assembling.

15. Levels.—To replace a broken level vial, remove the end plugs from the level vial holder, after removing the locking screws. Mark the plugs for replacement in the ends from which removed. Clean old setting and broken glass from the interior of the level vial holder. Set the level on a level plate. (Use the auxiliary level testing seat for the auxiliary angle of site level.) Locate the new level vial in the level holder with white paper backing and calcined gypsum (plaster of paris) setting, keeping the bubble as accurately centered as possible. Replace the end plugs and locking screws. Check the accuracy of the level when the plaster is firmly set. Correct any error by scraping the bottom bearing surface of the level vial holder, truing it to a surface plate.

SECTION VI

CARE AND PRESERVATION

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16. Method.—*a.* The contact surfaces of the angle of site level arm, level vial holders, sight socket and sight shank holder should

be kept clean and free from grit. Care should be taken that these surfaces are not nicked or dented, or otherwise damaged. The sight socket and sight shank holder should be kept lightly oiled.

b. About twice weekly, inject a small quantity of oil into the five oil holes provided. The oil hole in the deflection knob provides access to two oil holes in the deflection screw bearing, and oil should be injected into both of these holes. The oil hole covers should be opened only to permit oiling or inspection and should be kept closed at all other times.

c. Occasionally apply a few drops of oil on the collimating sight shank directly above the azimuth scale, at the same time pressing down on the shank and turning it so as to distribute the oil in the interior.

d. Use only the lubricants furnished by the Ordnance Department. The specified lubricants are aircraft instrument and machine-gun oil (U. S. A. Spec. 2-27) and Royco 6A. (See OFSB 6-F-1.)

e. Allow no oil or grease to reach the optical parts of the collimating sight or the glass surfaces of the level vial.

f. The sight should be dried as soon as practicable after use in inclement weather. The collimating sight should not be placed in the carrying case while wet.

APPENDIX

LIST OF REFERENCES

1. Standard Nomenclature Lists.

Sight, M1901 (French) ----- SNL F-28.
Tools, special repair pack, light and medium field SNL C-18.
artillery.

2. Technical Manuals.

Cleaning and preserving materials----- TM 9-850 (now
published as
TR 1395-A).
Matériel inspection and repair----- TM 9-1100.
75-mm Gun Matériel, M1897, and modifications--- TM 9-1305 (now
published as
TR 1405-75A).

3. Ordnance Field Service Bulletins.

Lubrication instruction for fire-control instru- OFSB 6-F-1
ments.

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